

MODEL GP-U4
GPIB unit
for digital storage oscilloscope VC-6041
OPERATION MANUAL

Hitachi Denshi, Ltd.

CONTENTS

	Page
1. Introduction	2
2. GPIB interface	3
2.1 General	3
2.2 Specifications	4
2.3 Interface and interface command functions . .	10
3. Functions of message command	14
3.1 Functions of message command	14
3.2 The format of message command	16
3.3 Format of transferring data	16
3.4 Delimiter	19
3.5 Status byte	19
4. Caution of protocol	21
5. Caution on the transmitting data	22
6. Programming example	23

1. Introduction

The Hitachi GPIB unit GP-U4 is general purpose interface bus system which conforms to IEEE(Institute of Electrical and Electronics Engineers) standard, which provides interface between digital equipments by using exclusive connectors and cables.

The GPIB unit is used for transmitting and receiving data between self-contained instrument or devices and the GPIB can support up to 15 independent devices connected in parallel with each other.

Data transmission instructions between digital storage oscilloscope VC-6041 and other independent devices such as personal computer via the GPIB are described in this manual.

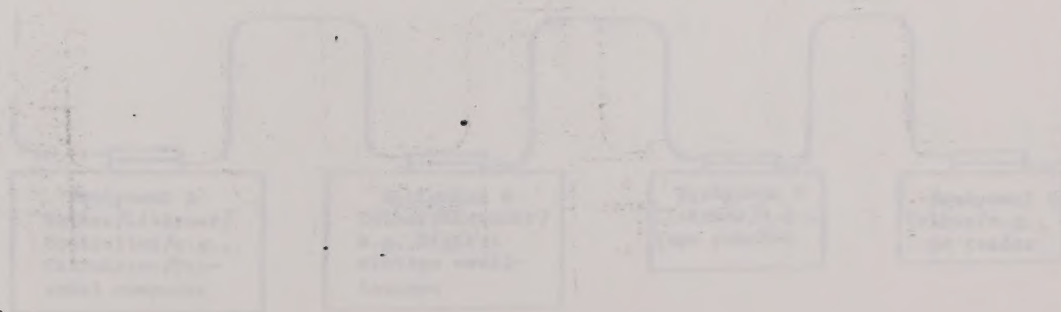


Fig. 1-1 Configuration of GPIB interface system

2. GPIB interface

2.1 General

Fig.2-1 shows an example of interface system with the GPIB. While only four instruments are shown, the GPIB can support up to 15 independent devices connected directly to the bus.

Connected equipment functions are sorted into the following three classes, talker, listener and controller.

During interface system operation, the connected equipment operates as the corresponding function.

A talker is an instrument that can send data over one listener or more listener, while a listener is an instrument that can accept data from the talker.

A controller is an instrument that determines which of the other instruments on a bus will talk and which instruments will listen during any given time interval. The controller also has the ability to assign itself as either a talker or a listener, whenever the program routine requires.

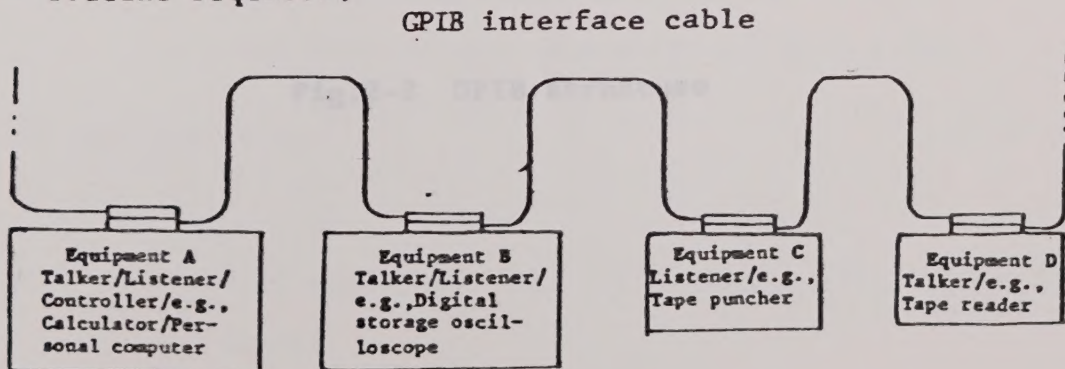


Fig.2-1 Configuration example of GPIB interface system

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2.2 Specifications

2.2.1 Bus

Figure 2-2 shows the 16 signal lines of the GPIB functionally divided into three component busses: an eight-line data transfer bus, a three-line handshake control bus and a five-wire management bus.

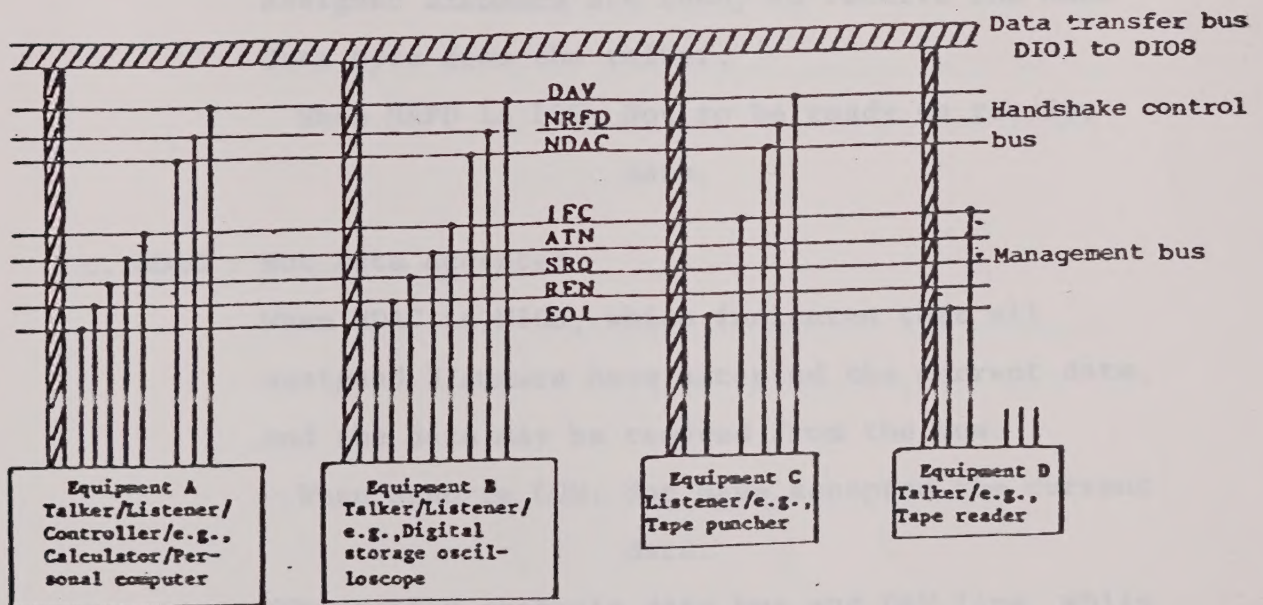


Fig.2-2 GPIB structure

(1) Handshake control bus

a. DAV : Data Valied

Asserts that a data on the data bus is valied.

When DAV is LOW : Data is valied for the listener.

When DAV is HIGH: Data is invalied for the listener.

b. NRFD : Not Ready For Data

When NRFD is HIGH, which indicates that all the assigned listeners are ready to receive the next data byte from the talker.

When NRFD is LOW: Not to be ready to receive data.

c. NDAC : Not Data Accepted

When NDAC is HIGH, which indicates that all assigned listeners have accepted the current data, and the data may be removed from the bus.

When NDAC is LOW: Not have accepted the current data.

(The talker controls data bus and DAV line, while the listener controls NRFD and NDAC lines.)

(2) Management bus

a. IFC : Interface Clear

Only the system controller can generate this IFC signal.

When IFC is LOW at least for 100 μ s, all interface of the talker and listener are quiescent state, then the control priority is send over the controller.

b. ATN : Attention

Only a controller can generate the ATN signal.

ATN is LOW : Only instrument adress codes and control message can be tranferred over the data bus.

ATN is HIGH: Only those instruments enabled as a talker and listener(s) can transfer data. .

c. SRQ : Service Rquest

Any instrument connected to the bus can request the controller's attention by sending the SRQ message.

SRQ message can send only when IFC is HIGH.

d. REN : Remote Enable

The system controller sends the REN message to an instrument whenever the interface system is operating under remote program control.

e. EOI : End Of Identify

A talker can use the EOI message to indicate the end of a data-transfer sequence.

When ATN is HIGH, the talker sends the EOI LOW message to indicate the last byte of data is transmitted.

(3) Data bus

DIO1 to DIO8 : Data Input Output

The data bus has eight bidirectional signal lines, DIO1 through DIO8. Information, in the form of data bytes, is transferred over this bus.

A handshake sequence between an enabled talker and the enabled listeners transfers one data byte at a time.

Data bytes in either an interface or device-dependent message are sent in a byte-serial sequence over the data bus.

2.2.2 GPIB connector and cable

Physical arrangement of the 24-pin GPIB connector (located on the rear panel) meets IEEE-488-1978 GPIB standards.

Twenty-four pins are as shown in Fig.2-3; sixteen pins are assigned to specified signals, and eight to grounds.

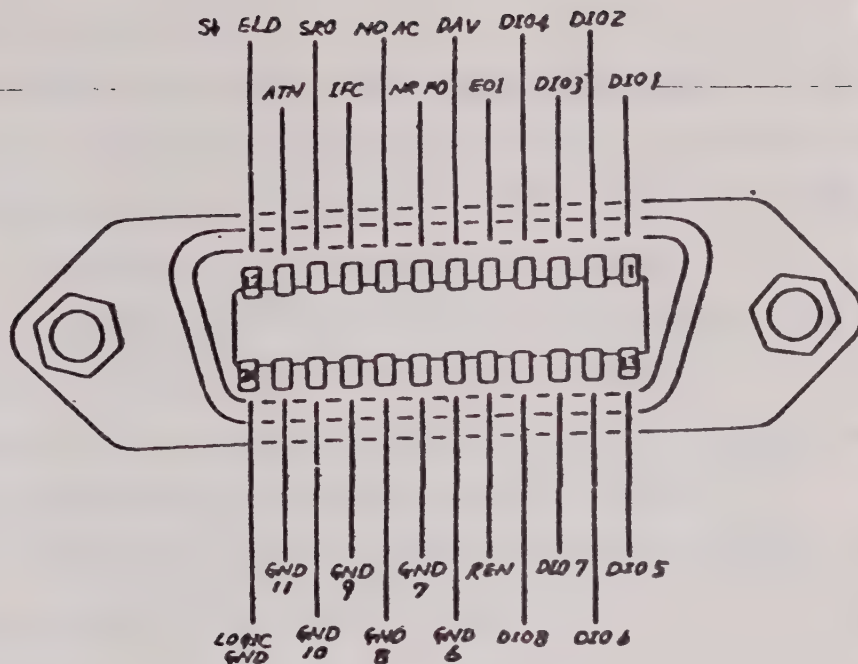


Fig.2-3 GPIB interface connector

Use a double shielded GPIB cable which especially meets the following conditions in IEEE-488-1978 GPIB standard.

1. Total cable length : 20 m max.
(Total of each cable length)
2. Single cable length : 5 m max.
(One span connection)
3. Connectable equipment number : 15 sets max.
(Including a controller)

2.2.3 Address setting

The GPIB switch is located on the rear panel of the digital storage oscilloscope VC-6041. It is used for selecting the talk address or listen address to which the interface will respond.

The five sections 2 to 6 of the switch as shown in Fig.2-4 select a five-bit binary address.

Section 2 is the most significant bit of the address, and section 6 is the least significant bit.

This optional switch has been set to "1" (Section 6 is ON) as shown below at the factory.

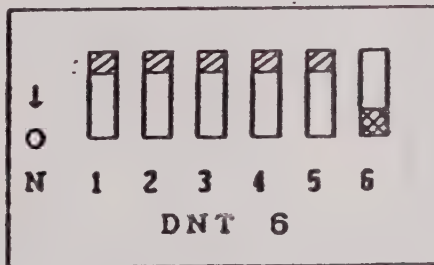


Fig.2-4 Address setting switch

2.3 Interface and Interface command functions

The VC-6041 Digital Storage Oscilloscope is equipped with a talker/listener functions. Table 2-1 is a listing of the interface functions: Tables 2-2 to 2-4 are the listings of the interface commands.

No.	Identification	Description	Oscilloscope's function
1	SH (Source Handshake)	Transfer message onto data bus.	SH1: Complete capability
2	AH (Acceptor Handshake)	Receive message from data bus.	AH1: Complete capability
3	T (Talker)	Send data to another device over data bus.	T6: Basic talker Serial poll, Talk address release (In MLA status)
4	L (Listener)	Receive data from another device over data bus.	L4: Basic listener, listener address release (In HTA status)
5	SR (Service Request)	Request service asynchronously from controller.	SR1: Complete capability

No.	Identification	Description	Oscilloscope's function
6	RL (Remote/Local)	Select remote/ local source. (Program control/ Front panel control)	RL0: No capability
7	PP (Parallel Poll)	Present a status information (PPR message) of 1 bit to controller without addressing to talk.	PP0: No capability
8	DC (Device Clear)	Device(s) in groups or individual is (are) initialized.	DC1
9	DT (Device Trigger)	Start each or each group of device(s).	DT0: No capability
10	C (Controller)	Send device address, universal command and addressed command to another device over data bus.	C0: No capability

Table 2-1 Interface functions

No.	Identification	Description	Oscilloscope's function
1	LLO (Local Lock Out)	Disable switch operations.	None
2	DCL (Device Clear)	Initialize all the bus functions.	Initialize GPIB.
3	PPU (Parallel Poll Unconfigure)		None
4	SPE (Serial Poll Enable)	Establish serial poll mode.	Establish serial poll mode.
5	SPD (Serial Poll Disable)	Release serial poll mode.	Release serial poll mode.

Table 2-2 Universal commands

No.	Identification	Description	Oscilloscope's function
1	GTL (Go To Local)	Establish local mode.	None

No.	Identification	Description	Oscilloscope's function
2	SDC (Selected Device Clear)	Initialize selected device.	Initialize GPIB.
3	GET (Group Executive Trigger)	Provide trigger signal.	None
4	PPC (Parallel Poll Configure)	Establish parallel poll mode.	None
5	TCT (Take Control)	Take over control of interface.	None

Table 2-3 Address Commands

No.	Identification	Description	Oscilloscope's function
1	IFC (Interface Clear)	Initialize interface.	Clears data bus.
2	REN (Remote Enable)	Enable remote mode.	None (GPIB is always in the remote mode.)

Table 2-4 Uniline Commands

3. Functions of message command

3.1 Functions of Message command

There are two message commands of GPIB interface for the VC-6041 as listed below.

No.	Commands	Function	Remark
1	S1 Command	• Receive signal and commands the data aquisition in display memory according to the control panel status. (The same as SINGLE SWEEP operation) • When S1 command is received, a SINGLE SWEEP is displayed. When the sweep finishes, then "the data aquisition finish" status is sent.	Controller checks whether SQR is present on bus. Or detects SQR by interruption, then acquires status byte during serial poll.
2	Ri Command	• Command the data transfer of the measurement status or data of memory "i"s.	Controller sets the equipment (VC-6041) to a talker after transmitting the Ri command,

No.	Commands	Function	Remark															
2		• There are Ri commands as follows: Note <u>R0 (i)</u>; Send the measurement status in memories "i". (i=1 to 4) Note <u>Ri (m, n)</u>; Send "n" words from the address "m" of the memory "i". Notes; "i" indicates the memory number. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th>No.</th> <th>i</th> <th>Memory</th> </tr> <tr> <td>1</td> <td>1</td> <td>CH1 display memory</td> </tr> <tr> <td>2</td> <td>2</td> <td>CH2 display memory</td> </tr> <tr> <td>3</td> <td>3</td> <td>SAVE memory #1</td> </tr> <tr> <td>4</td> <td>4</td> <td>SAVE memory #2</td> </tr> </table> "m": Address in memories. Four-digit integer : 0000 to 3999 "n": Number of words. Four-digit integer : 0001 to 4000	No.	i	Memory	1	1	CH1 display memory	2	2	CH2 display memory	3	3	SAVE memory #1	4	4	SAVE memory #2	so that the required data communication is enabled.
No.	i	Memory																
1	1	CH1 display memory																
2	2	CH2 display memory																
3	3	SAVE memory #1																
4	4	SAVE memory #2																

Table 3-1

3.2 The format of message commands

(1) S1 command

(Note 1)
(Note 2)

S	1	DEL
---	---	-----

Note 1 : All data in ASCII coding.

Note 2 : Refer to the section 3.4.

(2) Ri command

R	0	(	i	)	DEL
---	---	---	---	---	-----

R	i	(	m	m	m	m	,	n	n	n	n	)	DEL
---	---	---	---	---	---	---	---	---	---	---	---	---	-----

i	: 1 to 4, Memory number
mmmm	: 0000 to 3999, Address in memory
nnnn	: 0001 to 4000, Number of data

3.3 Format of transferring data

(1) Measurement status data

ID	V.M.	I.C.	T.D.	V.D.	P.T.	G.R.	S.C.	DEL
----	------	------	------	------	------	------	------	-----

(, : Data delimiter)

See Table 3-1 for details.

(2) Waveform data

ID	ADDR	N	D1	D2		DN	S.C.	DEL
----	------	---	----	----	-------	----	------	-----

Data
//

(, : Data delimiter)

See Table 3-2 for details.

Table 3-1 The format for measurement status

No.	Abbrev.	Item	Format	Byte number	Remark
1	ID	Memory number	# X @	3	X indicates any number 1 through 4.
2	V.M.	Vertical Mode	"ΔCH1", "ΔCH2", "ΔADD" or "CHOP"	4	Δ: Space code (shifted to the right)
3	I.C.	Input Coupling	"ΔAC", "ΔDC" or "GND"	3	Δ: Space code (shifted to the right)
4	T.D.	TIME/DIV	Time: XX.X (Note 1) Unit: "ΔΔΔS", "ΔΔMS", "MICS"	9	X: Any number 0 to 9 (shifted to the right)
5	V.D.	VOLT/DIV	Volt: XX.X (Note 1) Unit: "ΔV" or "mV"	7	(Shifted to the right)
6	P.T.	PreTrigger word	0000 to 3999	4	
7	G.R.	Ground Reference	000 to 255	3	
8	S.C.	Sum Check	(00) ₁₆ to (FF) ₁₆ Binary data	1	
9	DEL	DELimiter	1. (C/R) (L/F) 2. (C/R) "EOI" 3. "EOI" (One out of above three)	Variable	Conform to delimiter of the HOST CPU.

Note 1 Four figures including the first decimal place.

Table 3-2 The format of the waveform data

No.	Abbrev.	Item	Format	Byte number	Remark
1	ID	Memory number	The same as Table 3-1 No.1.	3	
2	ADDR	Heading address	Decimal, four-digit 0000 to 3999	4	
3	N	Number of data	Decimal, four-digit 0001 to 4000	4	
4	D1	Data	Decimal, three-digit/1 datum 000 to 255	3	
5	S.C.	Sum Check	The same as Table 3-1 No.8	1	
6	DEL	DELimiter	The same as Table 3-1 No.9	Variable	

3.4 Delimiter

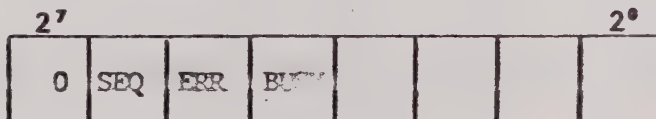
Choose one of three delimiters listed below.

For transmission, the same format as the delimiter of the message command is sent.

- 1) "EOI"
- 2) "C/R", "L/F"
- 3) "C/R", "EOI"

3.5 Status byte

The VC-6041 sends the status byte in order to respond to a message command, or to inform the status to the controller. The following is the format of these status bytes.



1. SRQ = 1 : Indicates that the SRQ is transmitting.
2. ERR = 1 : Indicates that the received data is in error status.
3. BUSY = 1 : Indicates that the VC-6041 is occupied.

No.	Status byte	Description
1	41	Data aquisition by S1 command is completed.
2	51	Indicates that the equipment is occupied.
3	61	Data format error.
4	62	SRQ is made when there is no transmitting data.

NOTE : Status byte is hexadecimal number.

4. Caution on protocol

- 1) The equipment responds to ANT with the first priority, and therefore, the processing is halted if the ATN becomes "L" during data transmission or in reception.
- 2) When TA or LAG is commanded succeedingly at the same address, the last command (TA or LAG) will be accepted.
- 3) Address command may be repeated.

However, the LAG and COMi address commands are repeated as follows, the only related LAG is processed. (Only portions of commands are processed.)

ATNL, LAG1, COM1, COM2, LAG2, COM1, COM2

ATNH

- 4) Universal command and address command may exist at the same time.

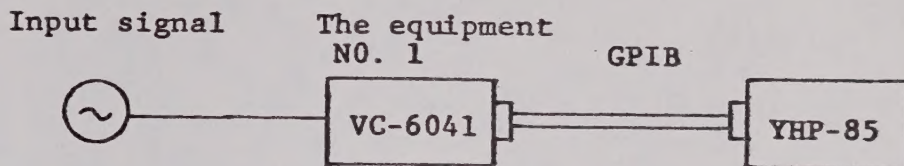
However, the command from universal command to the address command will require the TA command (or LAG command.)

5. Caution on the transmitting data sequence

- 1) Status byte is transmitted to inform the sequence error when a talker request is received while no transmitting data.
- 2) Error status is attached to the status byte when there is a format error in the message command.

6. Programming example

The following is an example of the programmes in the configuration of VC-6041 and YHP85.



Outline of the programme:

Receive the signal to print out waveform data and measurement status. Input channel: CH1

Output channel: 1000 words from 0 address

```
100 DIM A$(17000)
110 OUTPUT 701 USING "K";"S1"..... Transmit "S1" command.
120 STATUS 7,2;S2 ..... Status byte → S2
130 IF BIT (S2, 5)=1 THEN GO TO 150... Is Status byte 2ON? (SRQ)
140 GO TO 120
150 S=SPOLL(701) ..... Serial poll
160 IF BIT (S, 6)=1 THEN GO TO 180.... Is Status byte 2ON?
                                     S1 command process end.
170 GO TO 270
180 OUTPUT 701 USING "K";"R0(1)"..... Transmits "R0(1)" command.
190 ENTER 701; A$ ..... Receives measuring status
                                     data.
200 PRINT ..... Carrier return
210 PRINT A$ ..... Prints measurement status
                                     data.
220 OUTPUT 701 USING "K";"R1(0000,1000)
                                     ..... Transmits R1(0000,1000)
                                     command.
230 ENTER 701; A$ ..... Receives waveform data.
240 PRINT ..... Carrier return
250 PRINT A$ ..... Prints waveform data.
260 STOP
270 DISP "ERR. STATUS=";S ..... Error indication
280 END
```

